

EARTH SCIENCE NOTES

NAME _____

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UNIT I: COMPOSITION OF THE EARTH'S CRUST

1. Identify the characteristics of matter.
 - a. Measurements have a number and a unit.
 - b. Matter is anything that has mass and volume.
 - c. Weight is a measure of the pull of gravity.
 - d. Length- $1\text{m}=100\text{cm}$; $1\text{cm}=10\text{mm}$ (see ESRT p.1)
 - e. Mass (g) is the amount of matter in an object.
 - f. Volume (mL or cm^3) is the amount of space an object takes up.
 - g. Density (g/mL or g/cm^3) is the amount of mass in a specific volume of a substance ($D=m/v$... see ESRT p.1)
 - h. Usually, heating a substance makes it less dense, and cooling it makes it denser.
 - i. Increasing the pressure on a substance makes it denser, and decreasing the pressure makes it less dense.
 - j. Breaking a pure substance into smaller pieces will not change its density.
 - k. Most substances are most dense as solids.
 - l. Water is most dense as a liquid. At 3.98°C , the density of water is exactly 1g/mL (see ESRT p.1). Ice is less dense than liquid water.
 - m. Any measurement must contain some error (% Deviation... see formula in ESRT p.1)
2. Explain the importance of chemical bonds.
 - a. The internal arrangement of atoms determines what a substance is like. Salt is cubic because of the shape of its molecules.
 - b. Diamonds and graphite are both made of carbon. In a diamond, the carbon atoms have stronger bonds.
 - c. Solids, liquids and gases differ due to the speed that the atoms are vibrating (temperature) and the strength of the bonds.
3. Identify the characteristics of minerals.
 - a. Natural- not man-made
 - b. Inorganic- not alive, not from something alive, not once alive
 - c. Solid- not liquid, not gas
 - d. Definite chemical composition (ex/halite= NaCl ; galena= PbS)
 - e. Orderly atomic arrangement (crystalline)

4. Explain how minerals form.
 - a. Magma is a “soup” of molten (melted) minerals under ground. Above ground, it is called lava.
 - b. As magma cools, some minerals crystallize (solidify) before others. This allows different minerals to form separately from each other.
5. List the physical characteristics of minerals that are influenced by their crystalline structure.
 - a. Color
 - b. Streak- color of mineral as a powder
 - c. Luster- how a mineral’s surface reflects light (metallic or nonmetallic)
 - d. Hardness- Diamonds are hardest (10), talc is softest (1)
 - e. Density
 - f. Fracture- when a mineral breaks irregularly.
 - g. Cleavage- the way a mineral breaks along planes of weakness creating flat surfaces
 - h. Crystal form
 - i. Others- bubbles with acid, magnetism, taste
6. Identify rock-forming minerals by physical and chemical properties- see your Earth Science Reference Tables (p.16).
7. List and describe different categories of minerals: silicates & carbonates.
 - a. Silicates- the most common mineral group; contain Si and O; ex/ quartz, feldspar, mica
 - b. Carbonates- contain CaCO_3 ; ex/ calcite, dolomite
 - c. Oxides- metal combines with oxygen; ex/ hematite, magnetite
 - d. Sulfides- metal combines with sulfur; ex/ pyrite
8. Compare renewable & nonrenewable resources.
 - a. Chemical composition and physical properties determine how humans use minerals.
 - b. The properties of rocks determine how they are used and also influence land usage by humans.
 - c. Renewable resource- a resource that can be replaced in nature at a rate close to its rate of use (oxygen, trees, food, solar energy).
 - d. Nonrenewable resource- a resource that is used up faster than it can be replaced in nature (iron, aluminum, sand, coal, oil, natural gas, uranium).
9. Determine the densities of known materials.
 - a. Mass- triple beam balance
 - b. Mass of a liquid- find mass of container empty, find mass of container with fluid, subtract mass of container.
 - c. Volume of a regular object- $V = l \times w \times h$

- d. Volume of an irregular object- graduated cylinder (displacement of water)
- e. Volume of a liquid- pour it into a graduated cylinder.
- f. $D=m/v$

10. Compare/contrast the density of continental/oceanic rock

- a. Continental crust (more aluminum - felsic)= 2.7g/cm^3
- b. Oceanic crust (more iron and magnesium - mafic)= 3.0g/cm^3

11. Explain the difference between a mineral and a rock.

- a. Minerals are the “building blocks of rocks.”
- b. Rocks are mixtures of minerals. Rocks are usually made of one or more minerals.

12. Differentiate among the three major types of rocks.

- a. Rocks are classified on the basis of their origin: igneous, sedimentary or metamorphic.
- b. Igneous rocks form by the crystallization of molten magma or lava.
- c. Most sedimentary rocks form as a result of the compression and cementing of sediments under bodies of water.
- d. Metamorphic rocks form as a result of crystal growth without melting (recrystallization), usually under conditions of high temperature and pressure.

13. Distinguish between intrusive and extrusive igneous rocks and how they form.

- a. Intrusive rocks have large (1mm or larger) intergrown crystals. Ex/ granite, diorite, gabbro, pegmatite
- b. Extrusive rocks have small (less than 1mm) intergrown crystals or none at all (glassy). Some cooled so quickly that gas bubbles got trapped within them (vesicular). Ex/ pumice, obsidian, basalt, scoria

14. Explain the relationship between crystal size and cooling time.

- a. Intrusive rocks form when magma cools slowly beneath Earth’s surface, allowing enough time for large crystals to grow. Ex/ granite, diorite, gabbro, pegmatite
- b. Extrusive rocks form when lava cools quickly above Earth’s surface, not allowing enough time for large crystals to grow. Ex/ pumice, obsidian, basalt, scoria

15. Understand “interlocking” crystals- There is no cement or matrix holding the individual mineral crystals together. They are intergrown. Each crystal is touching another crystal, with nothing between them. Interlocking crystals are found in igneous rocks.

16. Distinguish among the types of sedimentary rocks and how they form.

- a. Inorganic land-derived sedimentary rocks are clastic (made of fragments of other rocks cemented together).

- b. Chemically formed sedimentary rocks are crystalline and usually form when water evaporates, leaving dissolved minerals behind.
- c. Organically formed sedimentary rocks (bioclastic) are the result of living things. Coal is made of plant remains. Limestone is made of cemented seashells.

17. Discuss features typical of sedimentary rocks.

- a. Inorganic land-derived sedimentary rocks are named by particle size. Ex/ Shale is made of clay-sized particles cemented together. Sandstone is made of sand sized particles cemented together. Conglomerates and breccias are made of a mixture of different particle sizes cemented together.
- b. Limestone has shells cemented together.
- c. Fossils are found only in sedimentary rocks.

18. Explain the processes involved in the formation of metamorphic rocks.

- a. Metamorphism results in the rearrangement of atoms in existing minerals subjected to conditions of high temperature and pressure.
- b. Contact metamorphism occurs when molten rock comes in contact with surrounding rocks. Transition zones from altered to unaltered rocks can be identified.
- c. Regional metamorphism occurs over large areas, and is generally associated with mountain building. The extreme pressures associated with the collision of tectonic plates (mountain building) can lead to the metamorphism of rock material.

19. Differentiate among different kinds of metamorphic rocks.

- a. Add pressure to clay (sediments), and shale (a sedimentary rock) forms. Add pressure to shale, and slate forms. Add pressure to slate, and phyllite forms. Add pressure to phyllite, and schist forms. Add pressure to schist, and gneiss forms. These are the events that turn a low-grade metamorphic rock into a high-grade metamorphic rock.
- b. Metamorphic rocks often show banding or mineral alignment (foliations).
- c. Metamorphic rocks often have distorted structures.

20. Learn how to use the ESRT chart for mineral and rock identification- See pages 6, 7 and 16.

21. Compare/contrast the processes in the rock cycle. (Use ESRT p.6)

- a. Any one type of rock can be changed into any other type of rock.
- b. Many processes of the rock cycle are the result of plate motions.
- c. When one plate dives beneath another, it melts. This leads to igneous rock formation and contact metamorphism.
- d. When plates collide, regional metamorphism occurs due to the great pressures exerted on large areas.
- e. Down-warping of the crust leads to the creation of major depositional basins